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Concentration of *net-extra-analis* mutation in *Drosophila melanogaster* populations from nature in 2000-2001.

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Mutations in the *net* gene (2-0.0) are known to disrupt the pattern of the wing veining. Currently, about two dozen spontaneous and induced alleles of this gene are known (Lindsley and Zimm, 1992; Biehs *et al.*, 1998; Brentrup *et al*., 2000). As a rule, analogously to *plexus* mutations, the *net* mutations lead to formation of a net of wing veins, as well as to appearance of additional longitudinal fragments of veins in the wing cells. Disruption of veining appears in all the wing cells, except the first dorsal ones, which are characterized by expansion to a distal part. The veins L4 and L5, beginning from the posterior cross-vein, are frequently joined together.

In different *net* alleles, the variation is observed in intensity of expression of the mutant phenotype. In heterozygotes with the normal allele, almost all known *net*-mutations are recessive, except the *net-41e4* allele. In this case, in half of the individuals with the genotype net^{41e4} / net^{+}, the small portion of additional veins could be registered, especially in the region L3 (Neel, 1942).

From the Belokurikha (Altai) population from nature in 2000, we have isolated an allele of the *net* locus (*net-B27*) with unusual properties. The phenotype of this mutation is characterized by an additional fragment of vein in the third dorsal wing cell, near by the middle of the longitudinal anal vein (Figure 1b). In the flies homozygous for net^{B27}, the mutation was incompletely penetrant (about 80%). The expression of the mutation varied relative to the length of an additional vein. With respect to the normal allele of the *net* locus, the net^{B27} mutation is recessive.

The phenotype of individuals heterozygous for the Altai allele of net^{B27} and the standard *net* allele from the collection of the Laboratory of Genetics of Populations of the Institute of Cytology and Genetics SB RAS, which produces multiple disruptions of veining in homozygotes (Figure 1a), is similar to the phenotype of the homozygotes net^{B27}. Unlike net^{B27} / net^{B27}, an additional vein fragment in net^{B27} / *net* appears in all the individuals and has a somewhat larger length than in mutant homozygotes. In net^{B27} / *net,* the additional fragment of the vein is sometimes formed as a small branch deviating from the posterior cross-vein in the third dorsal wing cell. Thus, the net^{B27} allele dominates over the standard mutant *net* allele.

All the individuals with the phenotype net^{B27} / $Df(2)net^{62}$, where $Df(2)net^{62}$-chromosome 2 carries a deletion in the region 21_1-21_4-5 involving the *net* and *giant larvae* genes (Korochkina, Golubovsky, 1978), have the additional fragments of veins or branches in the second and third dorsal wing cells and in the distal part of marginal and sub-marginal wing cells.

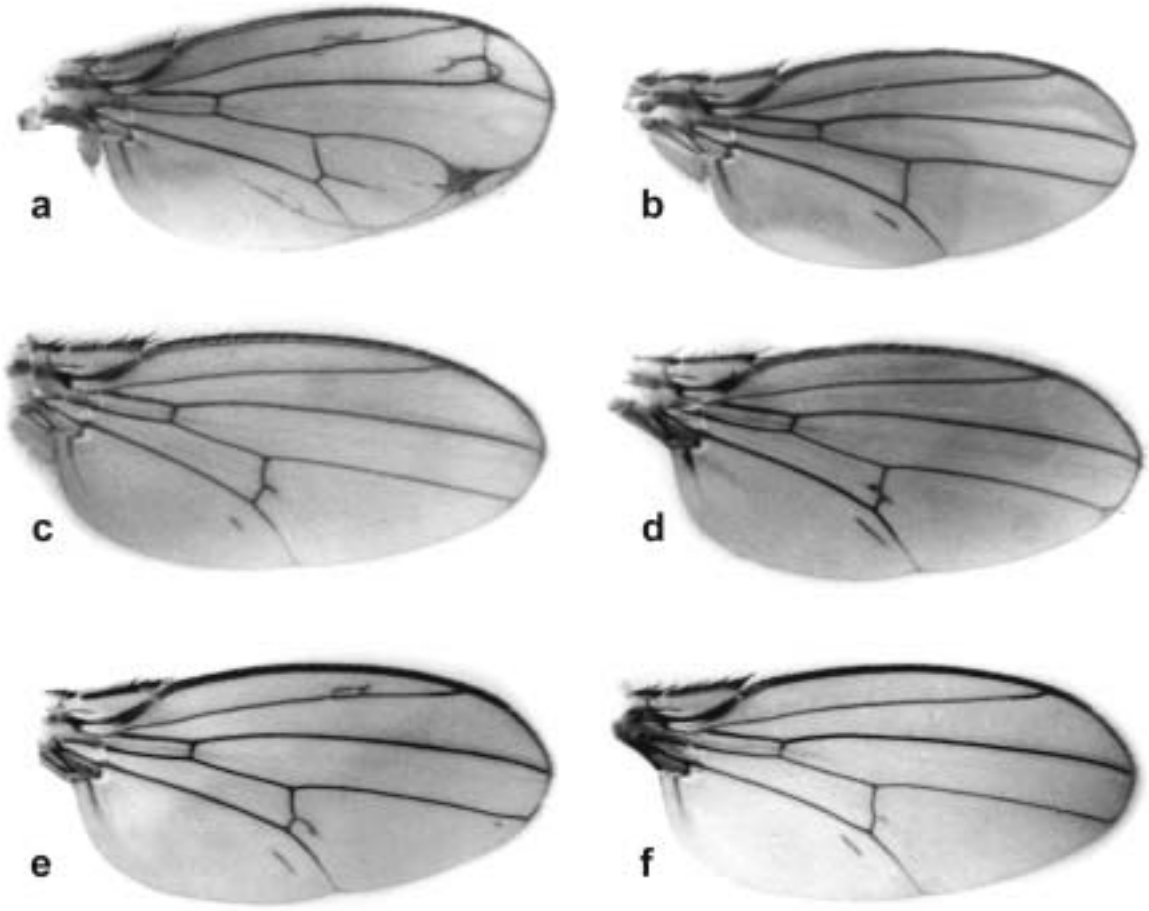

Figure 1. Variants of *net-extra-analis* phenotypes in homozygous and heterozygous with $Df(2)net^{62}$ and *net.* _. *net;* b. $net\text{-}extra\text{-}analis^{-27}$; _. $net\text{-}extra\text{-}analis^{U87}$; d $net\text{-}extra\text{-}analis^{Z14}$; e. $net\text{-}extra\text{-}analis^{Z14}$ / $Df(2)net^{62}$; f. $net\text{-}extra\text{-}analis^{Z14}$ / *net.*

The *net* mutations with the phenotype similar to the net^{B27} phenotype were found in all regions in geographically remote populations studied by us in 2000 and 2001. Mutations were detected both in the flies caught directly from nature and in the offspring of female inseminated in the wild. For example, concentration of the *net*-chromosomes in population from Pyuchas in 2001 has reached the level of 8%. The homozygotes by different *net* alleles isolated from populations were characterized by somewhat differing variants of mutant phenotypes. Except the fragment of an additional vein in the third dorsal cell, we have observed the branching or fragments of veins in the other cells in location of the posterior cross-vein (Figure 1d). In heterozygotes with $Df(2)net^{62}$ and the standard allele *net*, the mutations isolated from nature were similar as net^{B27} (Figure 1e, f). According to phenotypic penetration, the *net* mutation disrupting the veining pattern near by the posterior cross-vein was termed by us as *net-extra-analis.*

By comparing the data of population from Pyuchas, Republic of Udmurtia, it is possible to note that in 2001, the concentration of the *net-extra-analis* mutation has increased from 2% to 8% (the sample number from populations is about 200 second chromosomes). Possibly, this genetic drift is related to the

Table 1. Occurrence of the *net-extra-analis* mutation during 2000-2001 in geographically remote populations of *Drosophila melanogaster* from nature.

Population, region	Total number of flies analyzed	Share of flies carrying *net-extra-analis* mutation, %	Number of families (offspring of females fertilized in nature)	Share of families carrying *net-extra-analis* mutation, %
Belokurikha, Altai region, Russian Federation, 2000	160	0	44	0.6
Pyuchas, Republic of Udmurtia, Russian Federation, 2000	325	0	48	9.7
Pyuchas, Republic of Udmurtia, Russian Federation, 2000	485	3.7	50	32.0
Beshkek, Kirghizia, 2001	247	0.8	75	7.6
Zvenigorodka, Cherkassy region, Ukraine, 2001	530	1.1	50	6.0
Vladivostok, Far East, Russian Federation, 2001	136	0.7	41	9.8

"founder" effect that appeared due to limited number of individuals in the studied population from nature, as well as due to strong seasonal fluctuations in the number of individuals.

Previously, in populational and genetical studies performed in the Laboratory of Genetics of Populations of IC&G SB RAS, the mutations with the similar phenotypic penetration were found in different years in various regions in geographically remote populations: in Ukraine population from Uman in 1987 (Figure 1c), in Altai population from Pospelikha in 1992, in Tadjikistan population from Dushanbe in 1990. The mutations isolated from nature were maintained in culture as homozygous strains in the collection of the Laboratory, but these data were not studied from the genetical view point.

As was mentioned in the well-known publication by N.P. Dubinin with co-workers (Dubinin *et al*., 1937), in all studied in 1933-1935 populations from Novorossyisk, Tashkent, Dagestan, and Crimea, the inherited aberrations in the chromosome 2 were detected. These aberrations were the type as *net-extra-analis* and denoted by authors as *extra-analis* and *plexus*-II. Their penetrance was expressed as formation of additional short fragments of veins in the region of the posterior cross-vein; however, they were not localized.

Based on the evidence given above, we may conclude that *net-extra-analis* mutations are constantly present in a noticeable concentration in the wild populations of *Drosophila melanogaster* from nature.

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Golubovsky 1978, Dros. Inf. Serv. 53: 197; Lindsley, D.L., and G.G. Zimm 1992, *The Genome of* Drosophila melanogaster. San Diego, CA, Academic Press Inc.; Neel, J., 1942, Dros. Inf. Serv., 16: 49.